Claims

[c1] 1. A method of MR data acquisition comprising:
prescribing a 3D imaging volume;
applying a pulse sequence that is applicable as a 3D pulse sequence with slice encoding and rewinder gradients disabled in one dimension;
acquiring 2D MR data to localize the 3D imaging volume;
enabling the disabled encoding and rewinder gradients in the pulse sequence;
applying the pulse sequence in three dimensions; and
acquiring 3D MR data of the 3D imaging volume.

[c2] 2. The method of claim 1 further comprising the step of modifying the pulse sequence between a 2D pulse sequence and a 3D pulse sequence in real-time and on-the-fly.

[c3] 3. The method of claim 1 further comprising the step of allowing adjustment of at least one of an FOV, a slice thickness, flip angle, matrix size, sampling bandwidth, and spatial saturation between real-time data acquisitions.

[c4] 4. The method of claim 3 further comprising the step of acquiring full k-space data for one MR data acquisition after an adjustment, and then acquiring partial k-space data thereafter until a subsequent adjustment.

[c5] 5. The method of claim 1 wherein the steps of acquiring 2D MR data is sped up by first acquiring one set of complete k-space data, and then acquiring a subset of k-space data thereafter.

[c6] 6. The method of claim 1 further comprising the step of detecting object movement during real-time data acquisition and if object movement is detected, acquiring full k-space data for at least one MR data acquisition and acquiring partial k-space data thereafter.

[c7] 7. The method of claim 6 wherein the step of detecting is performed by one of an automated detection using a navigator echo technique and manual observation of real-time generated images.

[c8] 8. The method of claim 1 further comprising the step of switching from 2D MR

data acquisition to 3D data acquisition within one repetition time (TR).

[c9] 9. The method of claim 1 as used in an MRA exam and further comprising:
injecting a contrast agent;
continuously applying the pulse sequence, acquiring 2D MR data, and displaying images in real-time until an arrival of the contrast agent in a monitor station; and then,
switching the pulse sequence to 3D acquisition and acquiring 3D MR data for the prescribed 3D imaging volume.

[c10] 10. The method of claim 9 further comprising the step of adaptively switching between a 2D monitor mode and a 3D acquisition mode for each of a number of prescribed 3D imaging volumes.

[c11] 11. An MRI apparatus to acquire MR images and switch between 2D and 3D image acquisition in real-time comprising:
a magnetic resonance imaging (MRI) system having a plurality of gradient coils positioned about a bore of a magnet to impress a polarizing magnetic field and an RF transceiver system and an RF switch controlled by a pulse module to transmit RF signals to an RF coil Assembly to acquire MR images; and
a computer programmed to:
modify a pulse sequence upon demand between a 2D pulse sequence and a 3D pulse sequence;
apply the pulse sequence and acquire MR image data in 2D and 3D based on the pulse sequence as modified on demand; and
reconstruct MR images.

[c12] 12. The MRI apparatus of claim 11 further comprising a user input to select the modification of the pulse sequence and wherein the modification is made within one repetition time of the pulse sequence.

[c13] 13. The MRI apparatus of claim 11 wherein the pulse sequence is a conventional 3D pulse sequence when in a 3D pulse sequence mode and has the slice encoding and rewinder gradients disabled in a 2D pulse sequence mode.

[c14] 14. The MRI apparatus of claim 11 further comprising a user input to adjust at

least one of an FOV, a slice thickness, flip angle, matrix size, sampling bandwidth, and spatial saturation between real-time data acquisitions.

[c15] 15. The MRI apparatus of claim 14 wherein the computer is further programmed to acquire full k-space for one MR data acquisition after an adjustment, and then acquire partial k-space data thereafter until a subsequent adjustment.

[c16] 16. The MRI apparatus of claim 11 wherein the computer is further programmed to detect object movement during real-time data acquisition and if object movement is detected, acquiring full k-space data for at least one MR data acquisition ad acquiring partial k-space data thereafter.

[c17] 17. The MRI apparatus of claim 11 wherein the computer is further programmed to accelerate MR image data acquisition by first acquiring one set of complete k-space data, and then acquiring a subset of k-space data thereafter.

[c18] 18. A computer program stored on a computer readable storage medium having a set of instructions executable by a computer to cause the computer to:
use a common pulse sequence to acquire MR images in 2D and 3D;
receive an input indicating an operator desire to acquire 2D or 3D images;
if the input is indicative of a desire to acquire 3D images, apply the common pulse sequence with 3D parameters; and
if the input is indicative of a desire to acquire 2D images, apply the common pulse sequence with 2D parameters.

[c19] 19. The computer program of claim 18 that further causes the computer to:
disable parameters in a third dimension in real-time to modify the common pulse sequence to create and apply an effective pulse sequence;
acquire MR data; and
reconstruct an MR image.

[c20] 20. The computer program of claim 18 that further causes the computer to accept an input allowing adjustment of at least one of an FOV, a slice thickness, flip angle, matrix size, sampling bandwidth, and spatial saturation between real-time data acquisitions.

[c21] 21. The computer program of claim 20 that further causes the computer to acquire full k-space data for one MR data acquisition after an adjustment, and then acquire partial k-space data thereafter until a subsequent adjustment.

[c22] 22. The computer program of claim 18 that further causes the computer to detect object movement during real-time data acquisition and if object movement is detected, acquire full k-space data for at least one MR data acquisition and acquire partial k-space data thereafter.

[c23] 23. The computer program of claim 19 that further causes the computer to accelerate data acquisition by first acquiring one set of complete k-space data, and then acquire a subset of k-space data thereafter.

[c24] 24. The computer program of claim 18 that further causes the computer to convert the common pulse sequence from 3D to 2D within a single repetition time.

[c25] 25. A method of acquiring MR images in a 3D MRI study comprising the steps of:
identifying a desired imaging volume;
entering a real-time monitoring mode using a modifiable pulse sequence in a 2D mode;
navigating in real-time by acquiring and monitoring 2D images until the desired imaging volume is sufficiently located;
switching the modifiable pulse sequence from the 2D mode to a 3D mode; and
acquiring 3D images of the desired imaging volume.

[c26] 26. The method of claim 25 wherein the modifiable pulse sequence is switched from one mode to another within a single repetition time.

[c27] 27. The method of claim 25 further comprising the steps of:
switching the modifiable pulse sequence from 3D to 2D after imaging the desired imaging volume;
allowing for further navigating; and
switching the modifiable pulse sequence to 3D and acquiring further 3D images.